What is Forensic Science?

Forensic science is *"the application of natural and physical science to the resolution of matters within a legal context" —Thornton.*
Therefore, forensic science is concerned with the crime, the suspects, followed by investigation and comparative/analytical analysis of the evidence, culminating in testimony regarding interpretation of analyses in the context of the crime.

When is Forensic Science Used?

The Marine Forensics Branch provides scientific support to NOAA Enforcement and other agencies including USF&WS, US Customs, and state wildlife law enforcement. Cases submitted for analysis primarily involve CITES, Endangered Species Act, Magnuson Act and/or Lacey Act violations. Determinations usually involve species identification, minimum number of individuals, and cause of death related to human and/or fishery interactions. Other determinations include differentiation of wild vs cultured game fish, identification of marine oils in consumer products and morphological identification of whole or partial marine animals.

Some History of Marine Forensics.....

Marine forensic activities began at the NMFS SEFSC Charleston Laboratory in the late 1970's when staff were first asked to provide scientific assistance to law enforcement. In the early 1980's, the staff participated in studies to validate isoelectric focusing (IEF) of soluble muscle proteins for species identification and further enhanced the analyses by using specific enzyme staining as a confirmation.

IEF was, however, not amenable to the identification of species of sea turtle eggs, cosmetics or oils. This led to the development of another method for species identification using fatty acid profiling. Requests to identify species not resolved by IEF and for evidence other than fresh meats such as blood and cooked meats have led to directed research into the development of DNA techniques in the 90's.

In 1997, the Marine Forensics Program along with the rest of the Charleston Laboratory was legislatively moved to the National Ocean Service, becoming the Marine Forensics Branch of the Center for Coastal Environmental Health and Biomolecular Research (CCEHBR). The Branch has grown to six full-time staff consisting of two protein/DNA analysts, one lipid analyst, three technicians and one evidence handler/archivist with occasional analytical assistance from individuals in other CCEHBR Branches including Marine Biotechnology, Marine Biotoxins, Marine Ecotoxicology, and Marine Mammals and Protected Species.

The Marine Forensics Branch is currently renovating a 2500 ft^2 area within the Center. The new facility, scheduled for completion in the Fall of 1999, will provide:

*State-of-the-art security with computerized card access system.
*Secure evidence storage area (dry, refrigerated, frozen)
*Dedicated and secure laboratory space for Protein (isoelectric focusing, immunoassay) and DNA analyses (PCR/RFLP, DNA Sequencing)
*Necropsy capabilities to investigate unusual mortalities in marine animals.
*State-of-the-art LIMS system with bar-coding capability to track evidence chain-of-custody, automate data collection, and prepare reports.

The breadth of expertise and the new state-of-the art facility lends itself well to an accredited multi-disciplinary approach to forensic analyses and continuing development of new technologies.

If you wish to learn more about Marine Forensics, please write to:

Center Director
Marine Forensics Branch
Center for Coastal Environmental Health
and Biomolecular Research
219 Ft. Johnson Road
Charleston, South Carolina, USA 29412-9110
Tel: 843-762-8500 - Fax: 843-762-8700
Email: Marine.Forensics@NOAA.GOV

National Ocean Service
Center for Coastal Environmental
Health and Biomolecular Research
Charleston, South Carolina

Welcome to the
Marine Forensics Branch
Center for Coastal Environmental Health and Biomolecular Research at Charleston

Goals :

**Support the NOAA Office of Enforcement's Mission: Ecosystem enforcement in the stewardship of sustaining and restoring our Nation's wealth of living marine resources*

**Provide scientific/technical support to law enforcement in cases associated with marine species*

**Provide scientific/technical support to fisheries and protected species managers*

**Conduct basic research to develop new methodologies to aid in marine forensic identifications*

**Provide investigative support in anomalous mortality events (ie marine mammals, sea turtles and fish)*

**Provide biochemical analyses in response to inquiries relative to species substitution*

What Kind of Samples Can be Used as Evidence?

The majority of Marine Forensics cases involve illegal take or trade in managed or protected species. Most often the evidence is raw meat, but other samples such as blood, eggs, fins or products may also be analyzed.

Evidence Frequently Analyzed

Sea Turtles	
Eggs	Whole egg or trace
Meats - Cooked & Raw	10gm > 0.5gm
Blood - Trace	5 drops or less
Cosmetics & Oils	10gm > 0.5gm
Fish	
Raw Meats	10gm > 0.5gm
Fins	0.5 - 1 cm^2
Blood Stain	5 drops or less
Eggs & Larvae	Whole sample
Marine Mammals	
Meats - Cooked & Raw	10gm > 0.5gm
Blood & Blood Stains	0.5ml - trace
Skin	0.5cm^2
Cosmetics & Oils	10gm > 0.5gm

Loggerhead Sea Turtle

Who is Qualified to Conduct Forensic Analyses?

Forensic analyses should be conducted by scientists who:

** are familiar with and practice forensic procedures;*
** are experienced with the methods used for species identification and understand issues of cross-contamination;*
** expect be subpoenaed to testify in support of the evidence or opinion they produce.*

Previous experience or training in expert witness testimony is very beneficial. Such criteria should increase the likelihood for a scientist to be stipulated as an "expert" in a court of law.

What are Standards or Voucher Samples?

Specimens which have been identified and documented as authentic by a recognized expert, is referred to as a "standard" or "voucher sample". The Marine Forensics Branch maintains a "library" of authenticated voucher samples for each of the analytical methods used to resolve legal issues. Collection of the standards from whole animals by authorized experts is conducted on a continual basis. The expert also provides signed documentation verifying the species. This form along with a chain of custody form must accompany the sample and be delivered with the standard to the Marine Forensics Archive, ensuring that no tampering has occurred. The Marine Forensics Archive currently has over 3000 individual voucher samples representing species of marine reptiles, mammals and fish.

How are Evidence Samples Most Freqently Identified?

Samples are currently identified by comparing either proteins (isoelectric focusing), lipids (fatty acid profiles) or DNA (PCR/RFLP or sequencing) components of the evidence to voucher samples.

Methods Commonly Used in Evidence Analysis

Isoelectric Focusing	Proteins in edible quality meats
Lipid Analysis	Oils & fats in eggs, cosmetics
PCR - RFLP	DNA - any tissue type (requires very little sample)
PCR - Sequencing	DNA - any tissue type (requires very little sample)

Voucher Sample

Steps to Submitting Quality Samples for Analysis

1. Chain of Custody and other case documentation should be started at the time the samples are collected.

2. Avoid cross-contamination of evidence samples:
   - Individually bag and label each piece of evidence. ***DO NOT*** *place multiple samples together in the same bag.*
   - Clean any collection tools between samples.

3. Freeze samples as soon as possible, or place in preservative as per instructions.
   If adverse or remote working conditions arise,
   ** keep samples as cool as possible until able to freeze*
   ** meats, fins or blood may be sun dried or packed in salt*

4. Notify forensic personnel prior to shipping evidence for proper shipping and handling procedures at 843-762-8512 or 843-762-8511.

5. Ship frozen samples on dry ice or frozen gel packs overnight to:
   NOAA NOS
   Marine Forensics Branch
   Attn: Evidence Handler
   219 Ft. Johnson Rd
   Charleston, SC 29412

NOS Marine Forensics Branch